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KEEPING SILT AT HOME

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Indian Legacy

The corn that ripples across our land these summery days is an enduring gift from the Indian. Over the centuries, the first American took a wild grass and brought it to aristocratic rank among the cereals. The Indian lacked the white man's science, but patiently and with no known tools save the unaided eye, bare hands, imagination, and dedication he shaped and domesticated a crop of value to the whole world.

It was corn that sustained the Pilgrims at Plymouth when their wheat crops failed. Then friendly Indians taught the settlers how to plant, cultivate, and harvest this New World grain. So important a staple was corn in colonial days that a law required dogs to be tied by a leg to prevent them from digging up the fish often planted for fertilizer in each corn hill. As settlers pressed westward they planted and improved the Indian's corn, and before long it became our Number 1 crop.

But corn is much more than food for people or feed for livestock. The products of its versatile kernel constantly touch our lives. In a typical day we encounter corn products, often unknowningly, in the shoes and clothing we wear, the paper we write on, the rug on our floor, in our medicine chest, the car we drive, indeed in a multitude of ways. For ARS scientists and their colleagues have turned the organic raw material of corn into many products for industry. Even so, science has only begun to exploit the possibilities of the starch granule.

Years earlier, ARS joined the States in a unified effort to disseminate the latest findings of corn production research. This mutual effort enables each State to share knowledge with its neighbors and to draw upon Federal research resources. It was this pattern that largely helped the rapid development and acceptance of hybrid corn.

What of the future? Perhaps the most ambitious work underway is the development of varieties containing the mutant gene opaque-2. The increase in lysine content brought about by this gene could make the protein of corn as nutritious as that of milk. In the world struggle against hunger such an achievement would give even deeper meaning to the Indian word for corn, "that which sustains life."

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coccidia parasite. . .

lives full cycle without host

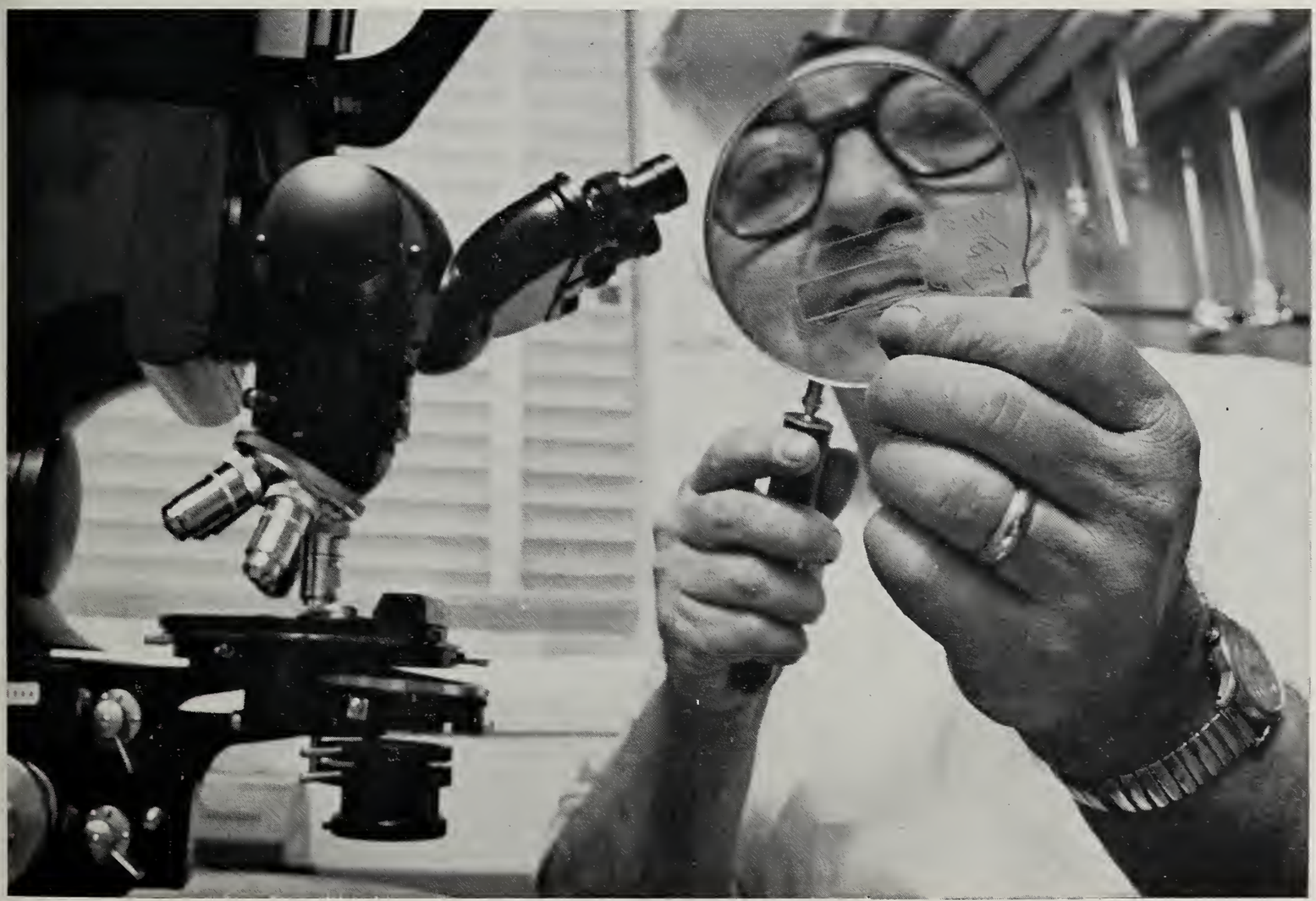
FOR THE FIRST TIME, a protozoan parasite has been cultivated in the laboratory through its complete life cycle—without the aid of its host. An ARS scientist scored this achievement with a poultry coccidium.

Coccidia have complicated life cycles and are difficult to study because they require a host in which to develop. Studying them requires sectioning tissues of the host animal and following their life cycles in this way is difficult at best. The actual cell-parasite relationship in the live animal cannot be observed since the host must be killed to take tissue samples.

In his first work with *Eimeria tenella*, which causes cecal coccidiosis in chickens, Dr. David J. Doran, ARS parasitologist at Beltsville, Md., found that he could cultivate the protozoan only through the second nonsexual generation—and a sexual generation is necessary before oocysts will develop. Oocysts produce spores which divide to form sporozoites, the infective stage of the parasite.

To try to complete the life cycle of the coccidium, Dr. Doran took sporulated oocysts and broke the hulls to release the spores. He then treated these spores with a solution containing trypsin and bile to release the infective sporozoites. While following these procedures in one experiment, Dr. Doran placed the sporozoites in a cell culture of chicken kidney that had been established from a suspension containing aggregates or clumps of

Dr. Doran checks a fixed stain culture before examining it under a microscope (370A132–17).



cells. Previously he had been using cultures established from single-cell suspensions.

Use of the cell aggregates rather than single cells proved to be the answer he was looking for—the protozoan completed its life cycle through the third nonsexual generation and into a sexual generation which formed the oocysts. Complete development of the protozoan took only 6 days, the same length of time it takes to develop in its natural host.

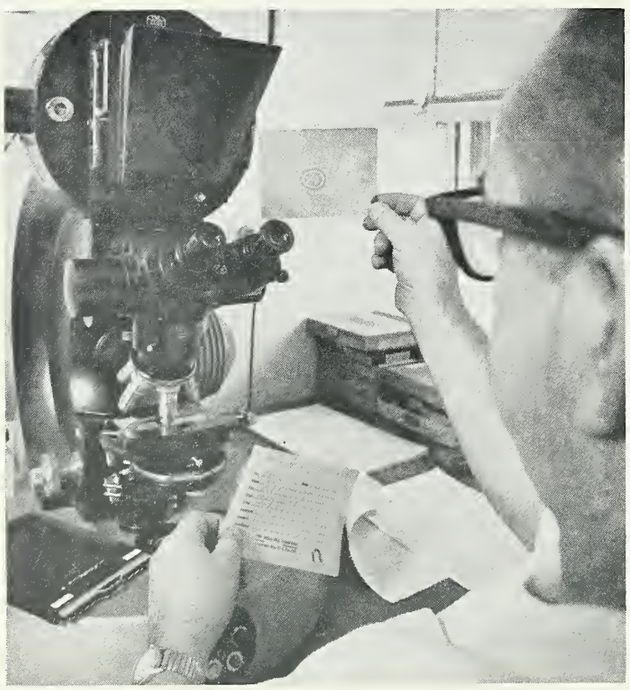
To test the infectivity of the oocysts developed in the cultures, Dr. Doran and a colleague, John M. Vetterling, inoculated healthy chickens. Six days later they had the answer. The chickens developed coccidiosis and expelled infective oocysts.

Now scientists can study the coccidium as it develops and observe not only the effect of the coccidium on the cell, but the reverse, the effect of the cell on the coccidium. Dr. Doran believes that coccidia grown in the cell cultures can be used for preliminary screening of drugs used against these parasites. And the intermediate stages grown in culture might be used to make vaccines. Eventually, coccidia for experimental work may be propagated in culture without the expense and problem of keeping host animals.

New doors are also now open to scientists interested in other protozoans that previously could not be grown through their life cycles in the laboratory. Some of these protozoans cause human diseases—diseases which may someday be better understood thanks to Dr. Doran's Work. ■

Cecal coccidiosis of chickens is caused by a tiny parasite—the coccidium. These coccidia invade the cells lining the cecum and multiply, destroying those cells and causing severe bleeding and death to the host. Coccidiosis may strike swiftly—one day the birds appear healthy, the next day, many are sick or dead. Sick birds recover slowly if at all. Hardest hit with this disease are larger commercial operations where birds are kept under closely confined conditions.

Coccidiosis is best controlled by preventing severe infection and building up resistance through light infections that are fought off by the birds. No vaccine is available at present.



***Left:** Dr. Doran examines a negative of a microscope photograph of an oocyst—the end product of the experiment (370A130–23). **Right:** Each tube contains cells of chicken kidney on a cover slip. Sporozoites are added, allowed to incubate 6 to 8 days, then the slips are removed for mounting (370A130–16).*

ARIE JAN HAAGEN-SMIT

Clean air crusader presents Morrison Lecture

EARTH'S ENVIRONMENT—today's newly popularized issue—is not a novel topic to scientists. Nearly 20 years ago, for example, an environmental "first" was made by an inquisitive Dutch biochemist, whose nose became offended by what we now call smog.

Arie Jan Haagen-Smit, a native of The Netherlands living in California, analyzed this offensive air and became convinced that it is produced when sunlight triggers a photochemical reaction between nitrogen oxides and hydrocarbon fragments of organic matter released into the air. He was the first to tag automobile exhaust as a major source of smog.

A professor at the California Institute of Technology, Dr. Haagen-Smit is now an internationally known clean air crusader. He has headed California's Air Resource Board since 1968 and chaired the President's Task Force on Air Pollution, which recently released its 5-month study.

Dr. Haagen-Smit was chosen to present this year's Morrison Memorial Lecture. The lecture series is sponsored by ARS to honor Benjamin Y. Morrison, the first director of ARS' National Arboretum. Dr. Haagen-Smit's lecture, "Man and His Home" was given in Williamsburg, Va., last April before a dinner meeting of the American Society of Landscape Architects.

In his lecture, Dr. Haagen-Smit urged a "planned and preventive conservation."

The balance of nature was upset, he said, because our ancestors believed that our resources—air, water, and soil—were infinite. The industrial revolution, with its thoughtless use and mismanagement of our natural resources, caused more pollution damage to materials in 136 years than occurred in the previous 2,240 years.

"It has become clear that, for the future, we shall have to do more than follow a system of repair." He noted that preventive conservation is less expensive than restorative conservation, and ". . . some ecologies once destroyed by man, can never be brought back no matter what we do . . . nor can we ever bring back a single acre of wilderness once it is destroyed."

Dr. Haagen-Smit said he believed that government and industry are responding to pleas to conserve the environment. But, he added, "bad practices ingrained over hundreds of years are not corrected overnight. The task ahead requires devotion and sacrifices, but the reward of breathing clean air is worth it." ■

Keeping Silt at Home

SUBURBIA with its denuded construction sites does its share to pollute the Nation's waterways with sediment.

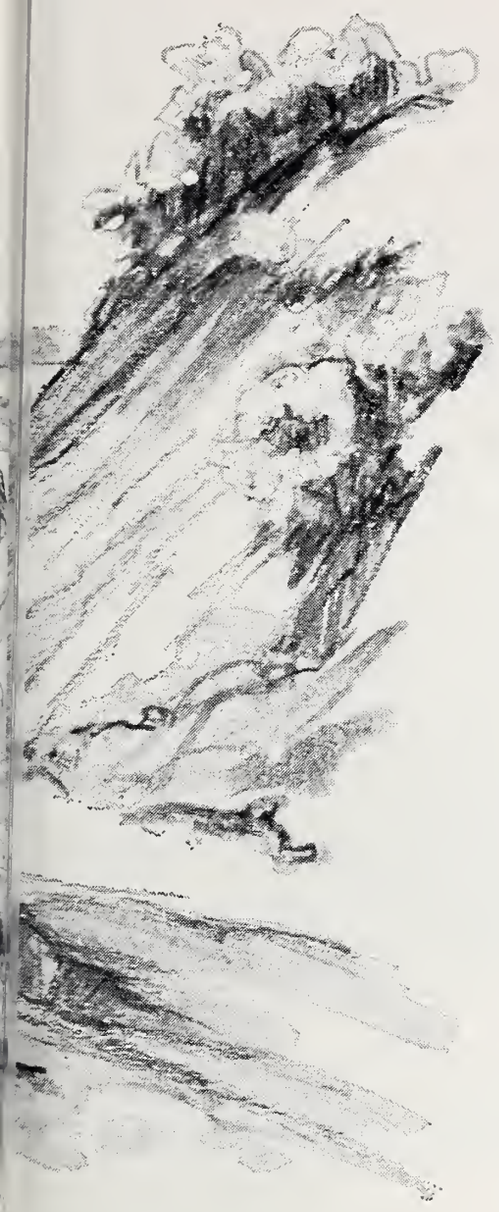
But a recent ARS study may provide the detailed information needed to help prevent runoff and erosion from typical construction sites. The study was conducted by agricultural engineer L. Donald Meyer and statistician Walter H. Wischmeier of ARS, and turfgrass specialist William H. Daniel of Purdue University Agricultural Experiment Station at Lafayette, Ind.

About a million acres of land in the United States are bulldozed each year for housing, business, roadway, airport, and reservoir construction.

Often, contractors and equipment operators ignore the hazards of runoff and erosion associated with major land modification. Even when these people are concerned, they may not be aware of the tremendous losses involved or of practical methods for reducing these losses.

For years, scientists have been studying various ways of stabilizing bare soil by such methods as spraying asphalt or spun glass, but plant cover remains the best insurance against erosion. The Indiana studies were conducted to define the best methods for reestablishing vegetation.

Those studies showed that covering a denuded area with a layer of top



soil, reworking compacted areas, seeding with a mixture containing fast-growing grasses, and using a surface mulch to be the best combination tested for minimizing soil erosion and enhancing rapid revegetation on reshaped land. The scientists studied six typical conditions found on denuded land areas when reshaped for residential and commercial development or highway construction.

The conditions included: (1) soil scalped only without further treatment; (2) scarified to a depth of several inches; (3) mulched with 1 ton of straw per acre; (4) covered with 4 inches of topsoil; (5) filled loosely with 2 feet of subsoil; and (6) filled with 2 feet of subsoil and then compacted thoroughly. The last two conditions were included to simulate depressions or ditches filled with soil.

Study plots were situated on a 12-percent slope. Simulated rainstorms totaling 5 inches were applied at an intensity of approximately 2.5 inches per hour. The first manmade storm lasted 60 minutes. Two 30-minute storms, 15 minutes apart, were made the following day.

The dominant conclusions from the study are that soil and water losses from denuded areas are great—as much as 8,000 cubic yards of deposited sediment from a 40-acre tract could occur with the simulated 5-inch rain—and that disturbed areas with surface mulch are much less erodible than areas under the other conditions.

For revegetation tests, the scientists divided the lower half of each plot into 24 subplots. Treatments studied were: (1) tilling or not tilling; (2) fertilizing at high or moderate rates; (3) seeding with a blend of vigorous bluegrasses or with 25 percent of the same blend plus 75 percent tall fescue; and (4) applying no mulch or 1 or 2 tons of straw mulch with asphalt binding per acre.

Seven of the subplots achieved a 90-percent stand 7 weeks after seeding. Six of these were on the plot that had originally received topsoil while the seventh was on the scarified plot. All had been tilled and covered with a straw mulch. Five plots were seeded with the fescue-bluegrass mixture.

The subplots with the best combination—topsoil, tillage, fescue-bluegrass seed mix. and mulch—averaged 77-percent establishment in the fall and 86 percent in the spring (range 75 to 95 percent). Both rates of mulch were better than no mulch; most unmulched subplots showed less than a 5-percent stand. The 2-ton rate, however, was considerably better than the 1-ton rate.

These test results thus provide a formula for keeping soil where it belongs. The next step is to apply the formula to the thousands of acres left each year "under construction." ■

***Below:** After the initial simulated rainstorm, researchers analyze the results in the test plot that was filled with 2 feet of subsoil and compacted thoroughly (PN–1883). **Cover:** The problem (MD–30503).*

New plant h

THEOPHRASTUS, a philosopher and naturalist of the 3d century B.C., wrote that the Greeks anointed the eye of the fresh fig with olive oil to accelerate its maturity. This may have been the earliest recorded use of naturally occurring plant hormones for agricultural purposes. Undoubtedly some kind of hormones were present in the olive oil of the Greeks—hormones perhaps not too unlike the newly found family of oily hormones, the brassins.

The brassins were isolated, purified, and chemically identified by a team of ARS scientists at Beltsville, Md., who thus added another major group of hormones to the widely accepted big four—gibberellins, auxins, kinins, and abscisins. The team included plant physiologist John W. Mitchell, chem-

Far left bottom: *Dr. Mitchell compares bean seedlings showing the effects of no hormone, gibberellin, and brassin treatments. Both length and diameter of the brassin-treated seedling show increased growth (ST–5367–20).* ***Far left:*** *Dr. Mitchell and technician Bruce Sidwell examine a rape plant (ST–5368–29).* ***Left:*** *Mr. Sidwell removes brassin from a chromatographic plate used to separate the hormone from other compounds. Technician Marjorie E. Drowne performs another separation step at the centrifuge (ST–5367–36).* ***Below left:*** *Mr. Sidwell applies hormone to a plant using a brain surgeon's microscope (ST–5368–36).* ***Below right:*** *Pollen pellets are kept in jars, and samples are weighed out into flasks. Hormone is extracted from sample, purified, and stored in a vial (ST–5367–25).*

rmone—the big No. 5

ist Nagabhushanam Mandava, plant pathologist Joseph F. Worley and chemist Jack R. Plimmer.

The brassin family complex, containing five chemical members, was named after the genus *Brassica* which includes the rape plant, from whose pollen the hormones were extracted. Apiculturist Maurice V. Smith of the University of Guelph, Guelph, Ont., Canada, supplied the rape pollen which proved to be a rich source of the naturally occurring hormones.

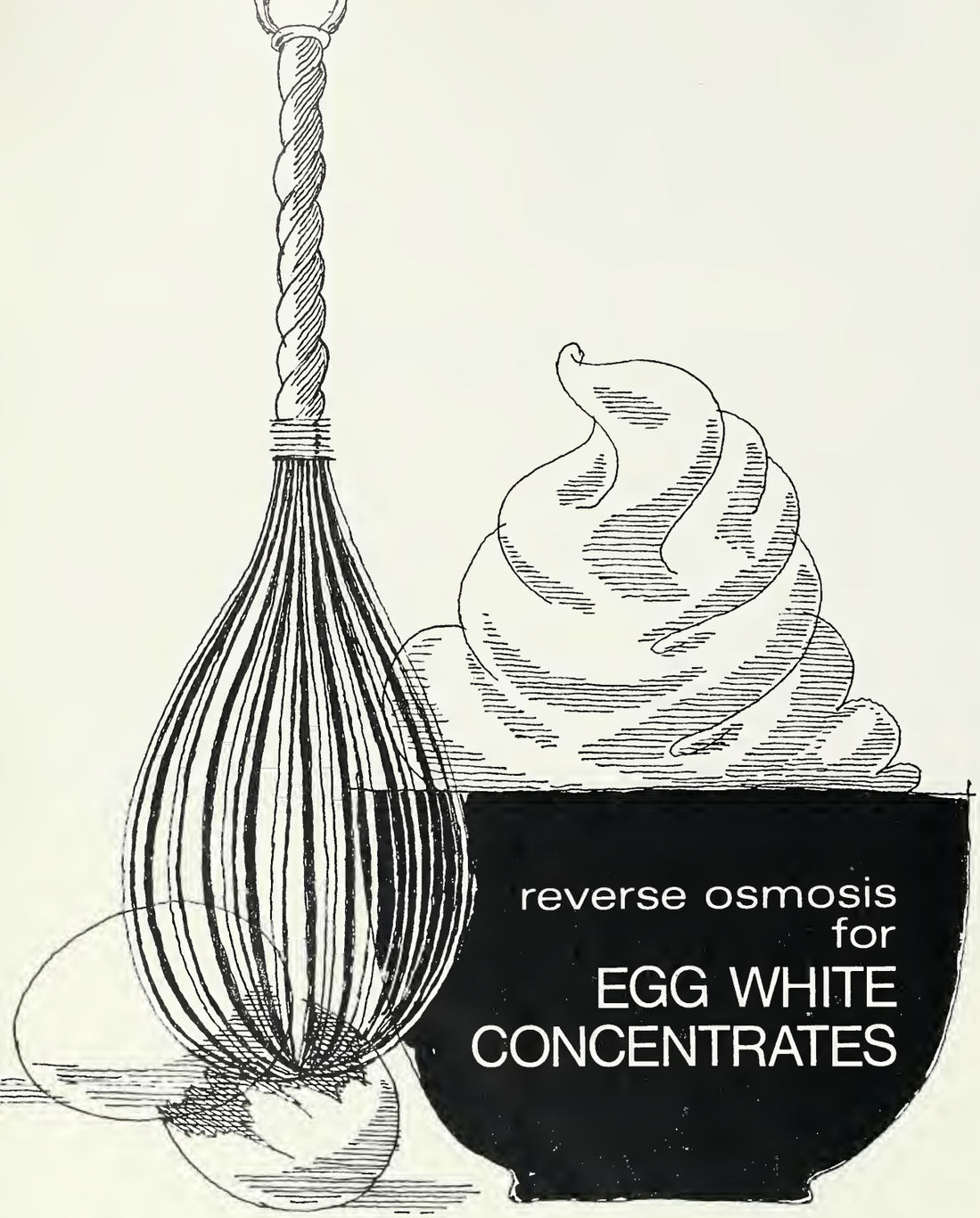
The new family complex represents the first fat-like compounds behaving as hormones to be extracted from pollen and chemically characterized as long-chain fatty materials. Analytical tests suggest that all five members have a glyceride structure and molecular weights ranging from about 250 to 580. And each of the five, when separated from each other, shows varying degrees of hormonal activity. The exact chemical structure for each of the five brassins is now in the process of being defined.

When tested on bean seedlings, the brassins caused—depending upon dosage and elapsed time—cell elongation in the second, third, and fourth stem internodes, lateral cell enlargement in the outer layers of the stem, and cell division in the upper half of the second stem internode. Brassins that were stored for 3 months at 4° C. showed no decreased activity.

Dr. Mitchell and his coworkers also tested pollen from other sources. Hormones extracted from alder pollen appeared to be similar to brassins chromatographically and similar in their biological activity. In addition, the scientists detected hormone activity in pollen from 15 different kinds of plants.

Up to now, there has been no direct and simple way to get abundant amounts of hormones from plants. However, with the new brassins from rape pollen, which is abundant, as much as 8 to 10 grams have been easily extracted from 100 pounds of pollen. No hormones have ever been obtained from crop plants before in these quantities.

The regulating role of chemicals in crop production is an established fact in agriculture today, and it may eventually prove to be a simple step from the bottles of synthetic chemicals to the natural brassins for regulating plant behavior. ■



reverse osmosis for EGG WHITE CONCENTRATES

REVERSE OSMOSIS, a process best known as a means of desalting sea water, may be the first practical method of concentrating egg white.

Egg white is used by food manufacturers in making confections, bakery goods, and premixed foods because of its ability to form foams stable enough to support relatively large quantities of flour or sugar, or both. About 62 percent of the production is dried, about 33 percent is frozen, and the remainder is fresh.

Scientists in the ARS Western utilization research laboratory, Albany, Calif., have now demonstrated that reverse osmosis could profitably be used in making both the dried and the frozen product. Previous experimental processes were not efficient or economical enough for commercial use. Participating in the research were engineers Edison Lowe, Everett L. Durkee, and Richard L. Merson, microbiologist Kosuke Ijichi, and food technologist Sheri L. Cimino.

In reverse osmosis, pressure applied to a solution forces water molecules through a membrane that does not pass most other molecules; thus, substances dissolved in the water are held back, becoming increasingly concentrated. Manufacturers can control to some extent the permeability of the membranes to increase selectivity in the size of molecules that will pass.

The scientists say that using reverse osmosis could cut costs of both the frozen and the dried product.

Removing part of the water in egg white before freezing, for example, would reduce the amount of material to be packaged, frozen, stored, and transported.

With the dried product, removing part of the water by reverse osmosis, then finishing the job by conventional drying, should cost less than doing the entire job conventionally. But even more important is the possibility of an improved dried product. The spray-drying process now employed damages the protein responsible for forming stable foam. This causes so much loss in whipping properties that additives must often be used for whites to produce stable foams when reconstituted.

But if part of the water were removed by reverse osmosis, which would not damage the protein, and the remainder by freeze-drying, the product could be reconstituted without additives. Processors have regarded freeze-drying as too expensive for the entire drying process, but it may be economical for drying a concentrate.

In experiments, reverse osmosis has removed about 60 percent of the water, 40 to 50 percent of the glucose, about 50 percent of the sodium and potassium salts, and about 20 percent of the calcium.

Equipment used in the Albany laboratory for this study was a slightly modified version of a laboratory-scale reverse osmosis unit designed there earlier specifically for food use. Most existing units are patterned after those designed originally for desalting saline water. ■

for more efficient processing

Movies That Feature Cotton

HIGH-SPEED motion picture photography is adding a new dimension to textile machinery research. Along with the usual measurements of quality and quantity ARS scientists can now determine cause and effect relationships.

High-speed photography—up to 8,000 pictures per second—has many characteristics that make it an ideal data-recording system for machinery research. It can provide a tremendous amount of permanently recorded information in a fraction of a second, and physical contact with the subject is not necessary.

Making a high-speed film is basically a simple procedure, but one that requires care in planning the film and setting up and operating the equipment. Application of the technique has proved quite fruitful at the ARS Southern utilization research laboratory, New Orleans.

During development of the Aerodynamic Cleaner, a machine designed to aid in cleaning trash from lint cotton, high-speed motion pictures provided just the information needed. The scientists were able to see in extreme slow motion the action of the cotton at the trash ejection point and thus design the critical parts for most efficient trash removal.

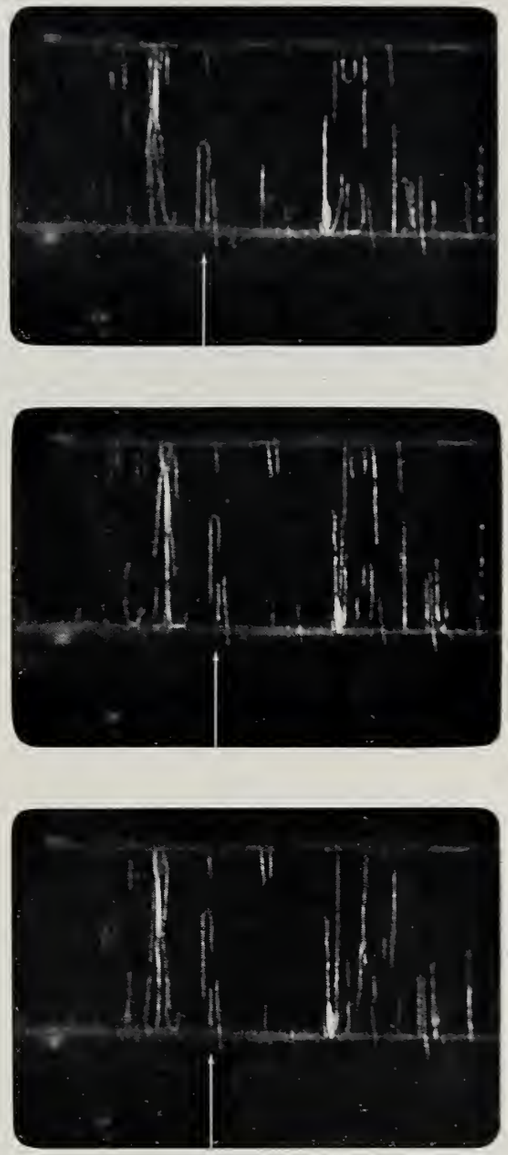
The high-speed movie camera was also used in a basic study of the action of cotton fibers in an electrostatic field. Results of the study show that fiber behavior is predictable in some respects and unpredictable in others. For example, the scientists know the fibers will migrate from one electrode to the other, but the rate of migration cannot be accurately predicted. As a consequence, the scientists are now planning to study in detail the precise behavior of individual cotton fibers.

Textile carding machines, which prepare fibers for spinning into yarn, may also benefit from high-speed photography. For example, the toothed feed cylinder, called the "lickerin," was studied to determine how efficiently it operated.

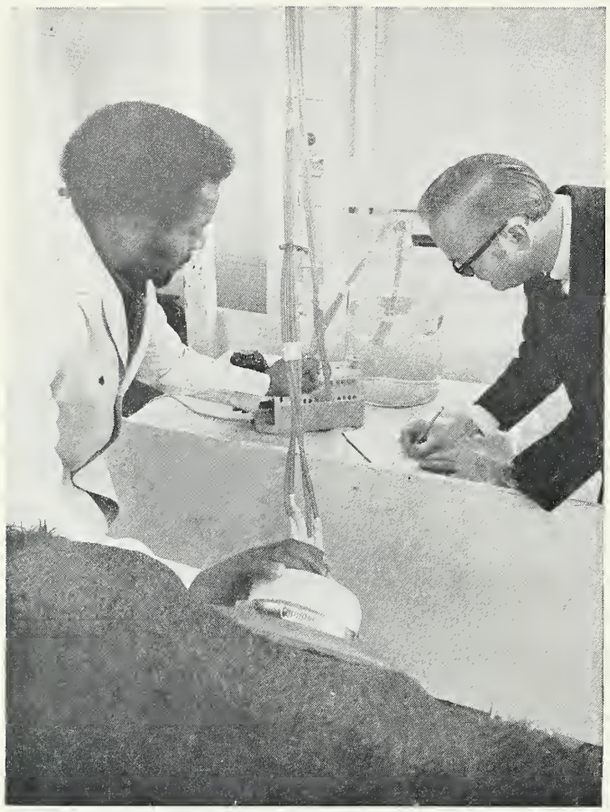
The film clearly showed that the tufts being fed to the machine were too large and established the need for reduced tuft size and improved fiber separation.

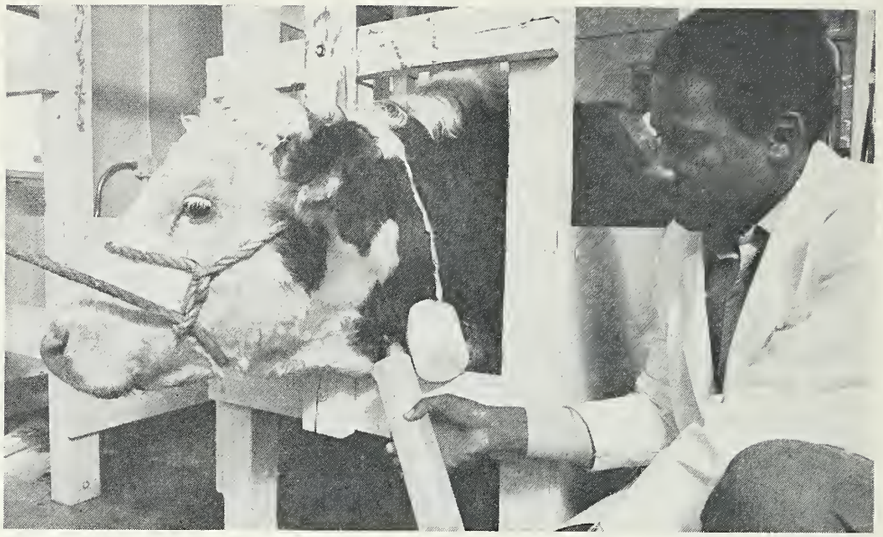
To get the most from the film, accurate analysis is essential. For this, ARS engineers use an analytical projector which offers projection speeds of 1 to 24 frames per second. It can be stopped for single frame analysis, run backwards, and projected on a screen with a grid so accurate, measurements can be made directly from the highly magnified image.

The textile machinery research program at the Southern laboratory meets an ever-changing series of technical problems. Most can be solved by relatively simple measurements and occasionally even by an educated guess. But for many problems the special characteristics of high-speed motion picture photography offer the best and often the only way to get a solution. ■

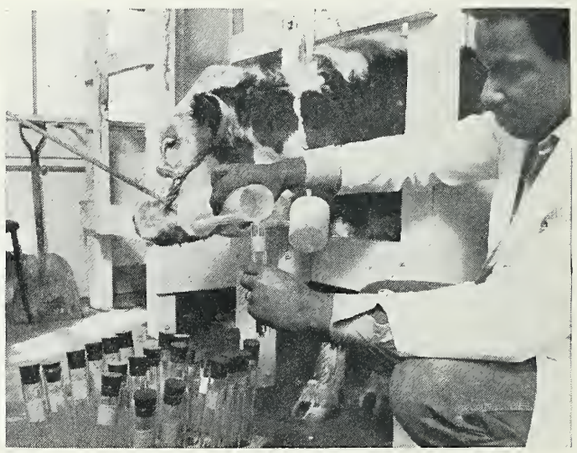


A series of three frames taken with high-speed film shows fiber migration between electrodes in an experimental method for alining fibers. As fibers move from left to right through an electrical field, they are attracted to the electrodes above and below and become parallelized and alined for spinning into yarn (PN–1884, PN–1885, PN–1886).





Left: As technician Lawrence I. Colbert feeds a urea solution directly into the rumen, Dr. Oltjen records its rate of flow (270A114–6). ***Above:*** *Technician Russell Lewis collects saliva samples from canula in steer's neck (270A114–19).* ***Right:*** *Mr. Lewis prepares saliva samples for laboratory analysis (270A115–7).*



Research shows why

Excess urea impairs digestion

TOO MUCH of a good thing can have bad side effects when feeding urea, a commonly used nonprotein nitrogen source in cattle rations.

Scientists have known for some time that urea causes a buildup of ammonia—a product of urea digestion—when it rapidly enters the rumen. ARS nutritionist Robert R. Oltjen found that ammonia, in turn, depresses the flow of saliva, sometimes as much as 80 percent depending on the ruminal ammonia concentration.

Saliva has several important roles in digestion. It serves as a carrier for certain minerals and as a lubricant which aids in swallowing. It also maintains the pH level of the rumen so that there is a proper acid-alkaline balance. This balance is vital for the survival of the microbes that digest food in the rumen.

The saliva also picks up urea that was not used in digestion but was recycled through the liver, absorbed by the blood, and collected in the salivary glands. Saliva from the glands carries the urea back to the rumen.

Urea is extensively used to replace costly vegetable protein for the production of meat and milk. But when cattle get too much too fast, problems can result. A steer may gorge himself when fed if feed is not available to him at all times. In this way he may take in more urea than he needs. Or, he may eat so fast that his digestive system cannot take care of the sudden influx of urea. Present and past recommendations have been that no more than one-third of the total dietary nitrogen should come from urea.

Dr. Oltjen recommends free-choice feeding of rations to cattle to make the best use of urea. With free-choice, cattle eat slowly, and the urea in the feed can be properly utilized without ammonia buildup.

Dr. Oltjen says that with the growing use of urea as a protein substitute and with the greater push to grow and finish cattle as fast as possible, problems with overdoses of urea may become more common. The future trend may be toward feeding a mixture of nonprotein nitrogen sources such as a mixture of part urea, part biuret and part uric acid. Such mixtures could lessen the possibility of too much ammonia in the digestive system at any one time. ■

ROUTING A TOXIC RANGE WEED

WESTERN FALSE HELLEBORE, a weed poisonous to ruminants, can be effectively controlled with a treatment program based on selective, nonpersistent herbicides.

The plant, *Veratrum californicum*, grows extensively on western ranges and causes significant livestock losses, particularly in sheep (AGR. RES., Feb. 1970, p. 15). It also occupies useful land and reduces the yield and quality of the more desirable forage species.

The control program was developed in cooperation with the Utah Agricultural Experiment Station, Logan, by ARS plant physiologist M. Coburn Williams and agronomist Lester B. Kreps. They evaluated 10 chemicals that, in related research over the past 20 years, have caused no harmful side effects in the environment.

Of the chemicals tested, they found that four—mecoprop, ester of 2,4-D, amine of 2,4,-D, and ester of silvex—provided complete control of *V. californicum* when the initial application was followed by a second application a year later.

The researchers conducted their experiments on especially dense stands of the weed growing on waterlogged plots which appeared to present the most difficult control conditions according to previous data. The chemicals were applied in a water diluent with a surfactant at 40 gallons per acre.

One application of 4 to 8 pounds per acre (ppa) of the active ingredients in each of the four effective herbicide formulations achieved 55 to 95 percent control the first year. Complete control was obtained the next year on all test plots after a treatment of 2,4-D amine at 4 ppa.

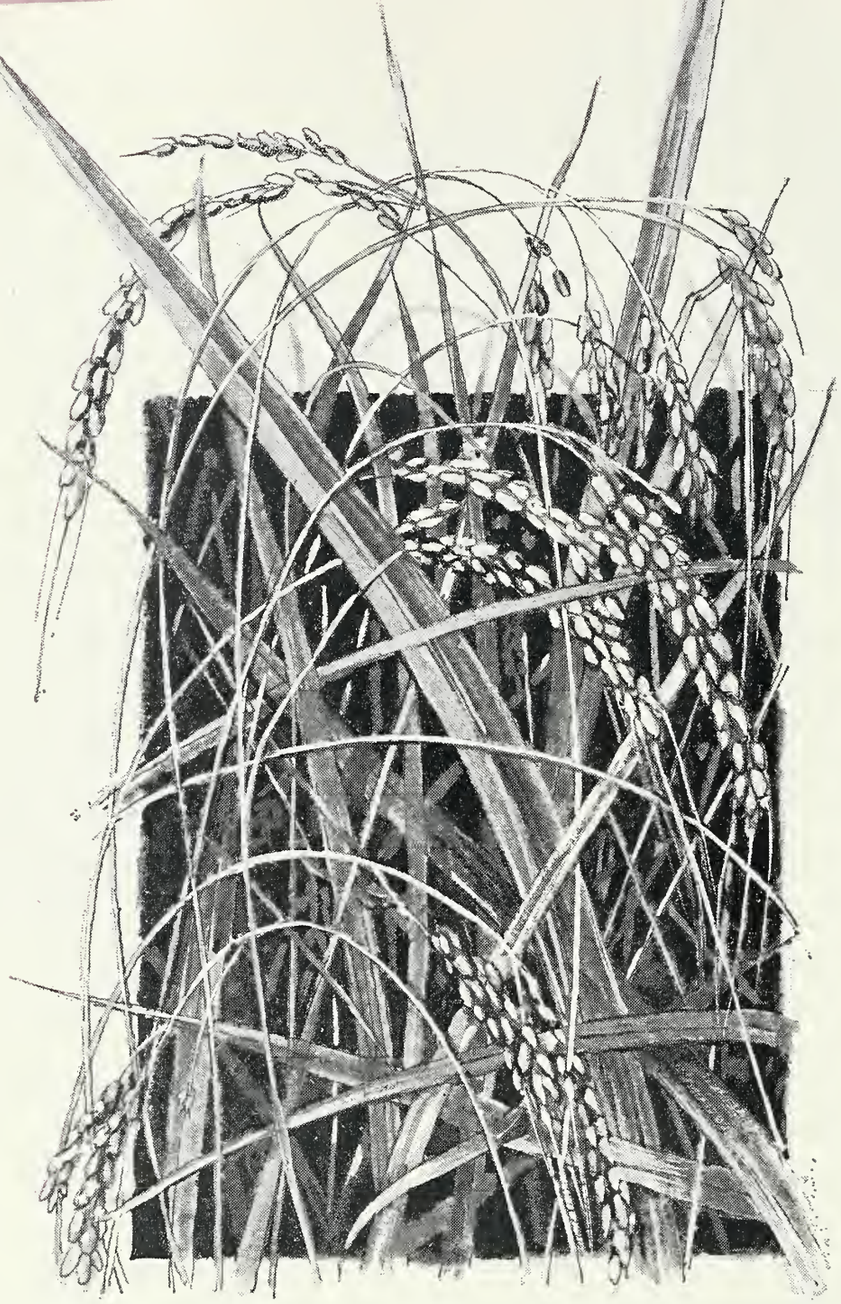
The chemicals were evaluated at two to four times the rates necessary, but data from plots that received one application a year for 2 years at 2, 3, and 4 ppa indicated that satisfactory control was possible at these relatively low rates. Mecoprop at 2 ppa followed by 2,4-D amine at 2 ppa was 99 percent effective. The other three herbicides were equally effective when applied at 3 ppa the first year followed by 2 ppa of 2,4-D amine the second. In some cases, on waterlogged plots particularly, one additional spot treatment was required to eradicate isolated plants not controlled by the two previous applications.

Once the herbicides controlled the *V. californicum*, ecological conditions for increased grass production were improved, and the grass in the treated area flourished. On the better-drained sites, Sandberg bluegrass and a bromegrass species were dominant, with some increase of sedge and purple oniongrass. On saturated plots, tufted hairgrass was the dominant species. However, the scientists point out that adapted forage species should be seeded to restore productivity quickly and to prevent invasion by undesirable species.

Once controlled, the weed didn't reinvade the cleared plots for at least 4 years, even though dense stands bordered the test sites.

All four of the herbicides are registered by USDA for use in grazing lands at the minimum effective rates in these studies. ■

Left: Dr. Kreps checks a plot of the weed in bloom (PN–1887). Right: These plants in Idaho are at the best stage for treatment (PN–1888).



timing guidelines for RICE FERTILIZATION

NITROGEN FERTILIZATION of rice is a tricky business.

Relatively high rates of nitrogen can materially increase grain yield. But if too much is applied or if it is applied at the wrong stage of plant development, the producer risks increased vegetative growth and disease, heavy lodging, delayed maturity, reduced yield, and lowered grain quality.

Recently the Arkansas Agricultural Experiment Station and ARS have identified the precise timing of midseason nitrogen applications for maximum yield of three varieties—Bluebelle (very short season maturity), Nova 66 (short season), and Starbonnet (midseason).

Previous research showed that rice responds to a split application of nitrogen—part at seeding and part as a topdressing near midseason. Exact timing at midseason is critical. Age of the plant is not a reliable guide because of year-to-year variations in climatic conditions. Instead, the best time proved to be soon after the internodes (stem sections) begin to elongate.

Arkansas agronomist Bob R. Wells and ARS agronomist Theodore H. Johnston point out that internode elongation occurs when plant development shifts from vegetative to reproductive growth. Rice varieties differ in development patterns so must be studied individually.

In field tests at Stuttgart, Ark., the scientists found that the best time for midseason nitrogen fertilization was when median internode lengths averaged 0.8 inch for Bluebelle, 2.3 inches for Nova 66, and 0.2 inch for Starbonnet. Delaying topdressing until these respective stages of plant development generally minimized plant height and lodging and increased grain weight and head rice yield. Furthermore, farmers have demonstrated their ability to recognize these critical stages for fertilization.

Bluebelle and Starbonnet, which have short, stiff straw, can effectively utilize nitrogen earlier in their development than Nova 66, a taller, broader-leaved variety. Nova 66 produced considerably more excess vegetative growth than the other two varieties when nitrogen was applied near midseason, before the onset of internode development. But when nitrogen was put on at the optimum internode lengths, plant height of Bluebelle and Starbonnet was ¾ to 1½ inches shorter and Nova 66 height was about 5½ inches shorter than that of plants fertilized earlier.

Similarly, nitrogen put on too early caused up to 73 percent lodging in Nova 66; little or no lodging occurred when nitrogen was applied at the optimum time. The other two varieties tested did not lodge.

The two researchers point out that Starbonnet and Bluebelle have plant types approaching those currently favored by many plant breeders. ■

AGRISEARCH NOTES

Less Nitrogen Means More Barley

The old saw about not overdoing a good thing applies to putting nitrogen fertilizer on barley in dryland areas.

Ralph E. Luebs, ARS soil scientist at Riverside, Calif., found that applying 40 rather than 80 pounds of nitrogen per acre to barley made a yield difference of 35 bushels. When no fertilizer was applied, yield was 27 bushels per acre more than with the 80-pound rate.

Dr. Luebs says that nitrogen increases the early water use of plants by increasing vegetative growth. The resulting reduction in available soil water increases the hazard of water stress on the crop between rains. Without sufficient water in the stage before heading, there are fewer grain-producing heads and fewer filled kernels per head.

In short, the amount of nitrogen that should be applied in dryland areas depends on the amount of water in the root zone and the probability of receiving additional rainfall.

These trials were conducted in cooperation with the University of California.

For Better Seed Peanuts

The greatest drawback in machine harvesting of peanuts is damage to the seed. Peanuts are knocked about considerably as they are dug, placed in windrows, combined, and handled. This reduces the seed's protection against mold and insect invasions and its germination potential.

Recent studies by ARS scientists at

Holland, Va., may help reduce this damage. ARS agricultural engineer Farrin S. Wright found that better seed peanuts generally result by digging early, putting the plants in conventional windrows, and harvesting after 3 days in the windrow at a slower than normal cylinder speed for the particular combine used.

To come up with that tentative conclusion, Mr. Wright studied the problem in two parts—a cylinder speed study and a plant orientation study.

In the cylinder speed study, variables investigated were three cylinder speeds (slow, medium, and fast), two feed rates (one-row and two-row windrows), and three windrow exposure times (0, 3, and 7 days). Best germination came from harvesting a two-row windrow at the slow cylinder speed after 7 days in the windrow.

In the plant orientation study, variables studied were three digging dates, two windrow types (random and inverted), and three windrow exposure times (3, 7, and 11 days).

That study showed germination percentages were higher for peanuts dug early after a minimum of 3 days in a conventional (random) windrow.

New Suspect in Alfalfa Damage

The alfalfa plant bug, blamed for losses in alfalfa seed production estimated at $900,000 a year, also may be responsible for damage in alfalfa forage.

In alfalfa field plot studies at St. Paul, entomologist Edward B. Radcliffe of the Minnesota Agricultural Experiment Station, and ARS geneticist Donald K. Barnes observed damage symptoms similar to those caused by potato leafhoppers. But . . . there weren't any leafhoppers in the plots. This indicated that potato leafhoppers weren't necessarily the exclusive cause of certain insect damage as previously believed. More likely, some of the damage might have been caused by a complex of leafhoppers, plant bugs, and perhaps other bugs.

Their findings are the first in which the alfalfa plant bug has been identified as causing extensive damage to alfalfa in field plots in the absence of leafhoppers. Some plants, however, resisted plant bug attack.

These observations, say the researchers, may be most important because, up to now, breeding for leafhopper resistance has been very difficult, and greenhouse and field data have not always agreed. Some of these differences could be due to differential plant bug resistance in plants with varying levels of leafhopper resistance.

This research may enable scientists to breed for plant bug resistance as well as to improve the efficiency of selecting for leafhopper resistance, thus aiding continuing ARS efforts to develop multiple resistance in alfalfa and other crops.

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AGRISEARCH NOTES

Drug Injection Cures Trichomoniasis

Further research with an experimental drug may lead to a cure for bovine genital trichomoniasis, an important disease of range cattle.

The drug, dimetridazole, has been used before in experiments to treat trichomoniasis. but five consecutive oral doses were necessary to bring good results (AGR. RES., Dec. 1963, p. 15). Donald K. McLoughlin, ARS parasitologist, recently found, however, that one intravenous injection of dimetridazole cured about 95 percent of the infected bulls treated at Beltsville, Md. An effective dose was 50 milligrams of drug per kilogram of body weight, and it could also be used to treat cows.

Infected bulls show practically no signs of the disease and spread trichomoniasis organisms to cows during mating. This infection may cause the cow to abort her fetus within 6 weeks of service. She can also spread the infection to "clean" bulls if mated with them. Infection in the cow may clear up if she is kept from sexual activity for several months. However, the bull may harbor the infection all his life if not treated. About 6 percent of this country's range bulls are infected, with a like number of infections in European bulls. Infection in dairy cattle is uncommon because of the wide use of artificial insemination.

Present treatments used to kill the *Tritrichomonas foetus* organism, which causes trichomoniasis, are expensive and often ineffective. If the bull is not an especially valuable one, it has often been cheaper to send him to slaughter.

Dimetridazole is not licensed by the Food and Drug Administration for use on cattle.

Mass-Rearing Corn Earworms

Automation that helped improve techniques for mass-rearing armyworms has now been adapted for corn earworms.

In rearing armyworms, a machine used by large restaurants to fill cups with jelly or salad dressing was modified to add insect diet and insect larvae to rearing cups and then to cap the cups—all automatically (AGR. RES., Jan. 1966, p. 10).

But with corn earworms, the insect diet had to be put in the cups at 135° F. and the larvae or eggs could not survive the heat. Thus workers had to dispense the cups, meter the diet into them, and set them aside until the diet had cooled and solidified. Then the cups were infested with eggs and capped by hand. It took 6 to 8 workers to hand-infest and cap 30,000 or more cups daily.

But all that has changed with the development of a cap-egging machine by ARS agricultural engineer Edsel A. Harrell and entomologists Robert L. Burton and Alton N. Sparks at Tifton, Ga.

The new machine handles the caps before they are inserted in the filling and capping machine. The cap-egger dispenses the caps upside down, brushes a small amount of glue into a depression in the center, drops eggs onto the glue in the depression, inverts the cap, and restacks them ready for the filler-capper machine.

The method keeps the eggs out of the heated insect diet. When the larvae hatch, they make their way to the food at the bottom of the cup.

Correction: Horse Disease

AGRICULTURAL RESEARCH incorrectly stated last April that the National Animal Disease Laboratory first isolated the virus which causes equine viral arteritis. The NADL researchers were the first to photograph the virus in infected tissue, but the virus was first isolated by University of Kentucky scientists. We regret that our article did not give Professors Elvis R. Doll, John T. Bryans, William H. McCollum, and M. Ward Crowe the credit due them.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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